STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : The Files

DATE: 5 September 1957

FROM [redacted] 25X1

SUBJECT: Contract RD-71, RR-AA/11 Receivers [redacted] 25X1

1. On 21 August 1957, I visited the plant of th[redacted] 25X1 to discuss certain short-comings of the tuner mechanism. Those attending the meeting were:

[redacted] 25X1

2. The discussion of deficiencies of the receivers were based in large measure on the following reports: The "Summary of Test Data, Conclusion and Recommendations on the RR-11/AA Receiver", dated 14 September 1956. "Checks on the RR-11AA Receiver No. 9 in conjunction With RF Tuner No. 15," dated 15 October 1956, "RR/AA-11 Receiver Calibration Check" dated 22 March 1957, "Summary of Measurement on Tuners No. 1-R and R-2 for RR/AA-11 Receiver" dated 9 August 1957. Also at this time, receiver Nos. 4, 5, 9 and 12 complete with tuners, and extra tuners No. R2 and 8 were given to [redacted] to check for malfunction. 25X1

3. The principal points of consideration concerning the tuner were causes of calibration error, calibration drift with time, and resetability error. As had been stated in the past, and at the offset of this meeting, it was again emphasized by both [redacted] ther 25X1 the development specifications No. 54-A-1028-A for RR/11-AA Transistorized communications receiver and development specification No. 55-A-1036-A for RR-11/BB transistorized communications receiver are design objectives rather than minimum standards of attainment. In one such instance, [redacted] felt that the specification imposed a most difficult situation, this in Section 2.1.2.1. receiver frequency calibration which states that the calibration accuracy of the tuning dial shall be within .1% throughout the tuning range. He felt that this accuracy could be relaxed somewhat without impairment of receiver operation, particularly when weighed against the next specification 2.1.2.2. dial resetability which states that the accuracy of resetability shall be within .01% when approached from either the high or the low end of the tuning range. [redacted] contends that the percentage calibration error becomes somewhat meaningless when one considers that .01% at 3 mc is 300 cycles and resetability at 12 mc is 1200 cycles. 25X1 25X1

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[redacted] feels quite strongly that a fixed resetability error of perhaps 2.5 kc should be allowed, this error to apply at all portions of the tuning range. It is further noted that the 2.5 kc proposed error is well within the bandpass specification of the intermediate frequency amplifier of 6 kc. In this light, [redacted] feels that calibration accuracy as such is not as important, particularly when the operator may be able to return to his original setting within the accuracy above stipulated. It is noted here that calibration accuracy does not meet specifications in most cases, nor is the specification on dial resetability met. However, it is of interest to note that dial resetability is close to the proposed 2.5 kc fixed error in most cases. In general, other performance characteristics of the receiver, such as spurious response, high frequency oscillator reradiation, and image frequency rejection ratio were not discussed at length, as these various items are considered to be relatively minor design problems, when compared to the complexity of obtaining the desired dial calibration accuracy. 25X1 25X1

4. The points of consideration to improve performance of the tuner were discussed at some length, together with the design changes necessary which would permit the device to be manufactured in production quantity. The [redacted] representatives had earlier made the flat statement that the tuner in its present configuration is not reproducible in production lots. These various points of discussion are not being made as a matter of record here as complete minutes of the meeting were kept and will be forwarded to us by [redacted] in the very near future, and inserted into the record. 25X1 25X1

5. In consideration of all factors involved, such as certain basic mechanical design changes, relaxation of certain specifications, particularly in consideration of size, the [redacted] people ultimately agreed that with proper tooling the device could conceivably be built at some reasonable cost. At this time, they would not venture an opinion as to magnitude of "reasonable cost" but agreed to submit a "ball park figure" to [redacted] in order that we may in turn be advised of the budgetary estimate of producting the receiver in lots of 100, 300 and 500. 25X1 25X1

[redacted] 25X1

Memorandum for File RD-27, Task II

1. As an adjunct to a meeting on between personnel from the Operations and Engineering Divisions concerning the operational requirements for the RS-11, the subject of a need for a transistor receiver was discussed. Briefly, the following statements were made by personnel form the Operations Division:

A. The transistor receiver development should not be made a part of the RS-11 program since present indications are that transistors still do not approach vacuum tube performance with respect to noise, sensitivity and high frequency coverage. (Engineers definitely concurred in this opinion for stated reasons ~~xxx~~ as well as for reasons of ~~xxxxxxx~~ incompatibility of power requirements (battery voltage in particular).

B. A transistor receiver of the size of the RS-11 receiver case (which would include its own ~~xxx~~ battery supply)would serve to satisfy a definite equipment needx as an auxiliary receiver especially in operations using hand generator power. RS-11 receiver is same size as BA-1264/U mercury battery.

C. A transistor receiver including its own batteries would permit two-antenna break-in operation with any existing agent set, ~~xxxxxxxxxxxxxxx~~ without complicated inter-wiring and with a minimum of excess weight.

D. A transistor receiver would be an excellent device for receiver only operations because of the low battery power requirement.

E. Such a receiver should cover the frequency range of 3 - 12 mcs for best present usage and should, in the future be expected to extend to 22 mcs. (Our contractor is at present holding to 8 mcs as an upper frequency limit).

2. Based on the above comments, we propose to prepare a set of operational requirements similar to those of the RS-11 receiver and submit them to various manufacturing groups for their comment and bid.

Right as

PROJECT #520 Specification

FREQUENCY COVERAGE:	3.0 to 12.0 mcs in two bands
A.M. SENSITIVITY:	15 microvolt signal (mod. 30%) will produce a 1.0 milliwatt output into 4000 ohm load.
SIGNAL-TO-NOISE RATIO:	15 microvolt signal (mod. 30%) will increase receiver output power 10 db over residual noise output.
IMAGE REJECTION RATIO:	30 db
I.F. REJECTION RATIO:	60 db
L.O. RADIATION:	Less than 1000 microvolts/meter (JAN I-225)
B.F.O. RADIATION:	Less than 1000 microvolts/meter (JAN I-225)
FREQUENCY CALIBRATION:	As high as can reasonably be obtained.
DIAL RESETABILITY:	Extremely critical. Less than 0.1% error
FIDELITY:	Overall frequency response shall be within ± 3 db for modulation frequencies between 250 and 3000 cps.
SIZE:	6 1/4 x 3 3/8 x 2 1/4 inches INCLUDING BATTERIES
BATTERY SUPPLY:	Mercury batteries within the receiver case shall be capable of 25 hours operation before the receiver sensitivity is reduced to one-half.
ADDITIONAL CONSIDERATIONS:	Case shall have a flush form factor (i.e. when the unit is stowed, it will have no projecting knobs, terminals, or controls). Set shall be capable of withstanding vibration shock, acceleration, and pressure normally encountered in transportation and drop of similar equipment. Set shall be able to operate reliably and be stored indefinitely in a tropical environment without failure due to such environment. Covers to seal set against dust, spray, and wind shall be provided, if feasible. Reliable operation at temperatures between 40 - and +40°C.

II - Operational Characteristics

1. Frequency Coverage

a. The frequency coverage of the receiver shall be 3 to 12 mcs.

b. The channel width of the receiver shall be sufficient to receive amplitude modulated speech signals and hand-keyed c. w. signals.

2. Emission Designation

a. The receiver shall satisfactorily receive A-1, A-2, and A-3 types of emmission.

3. Range of Reception

a. To achieve the desired range of reception, the receiver shall have a signal-to-noise ratio and a raw sensitivity equal to or better than the following specifications:

(1) A. M. Signal-to-noise Ratio must be such that a 15 microvolt signal modulated 30% with a 1000 c.p.s. tone will increase the receiver output 10 decibels over the residual noise output into a 4000 ohm load.

(2) A. M. Raw Sensitivity must be such that a 15 microvolt signal modulated 30% with a 1000 c.p.s. tone will provide an output of 1.0 milliwatt into a 4000 ohm headset load.

(3) C. W. Signal-to-noise Ratio must be such that an unmodulated signal of less than 15 microvolts will increase the receiver output 10 decibels over the residual noise output into a 4000 ohm load.

(4) C. W. Raw Sensitivity must be such that an unmodulated signal of less than 15 microvolts will provide an output of 1.0 milliwatt into a 4000 ohm headset load.

4. Interference Elimination

a. The receiver local oscillator shall radiate a minimum signal which shall in no case exceed 1000 microvolts per meter, tested in accordance with JAN I-225. The beat frequency oscillator radiation shall be similarly limited.

b. The receiver shall possess an image rejection ratio in excess of 30 decibels and an intermediate frequency rejection ratio in excess of 60 decibels.

c. The receiver shall have an order of selectivity as high as can be obtained consistent with the desired size and fidelity.

d. The receiver shall be free of microphonic and excessive noise (internal) interference.

5. Stability

a. The receiver shall exhibit the highest order of stability as is practical

6. Accuracy and Fidelity

a. The receiver shall exhibit a dial accuracy as high as can be obtained reasonably; however, great emphasis shall be placed on resetability since an error of less than 0.1% shall be the design criterion for resetting frequency.

b. The receiver shall exhibit sufficient fidelity for the reception of amplitude modulated voice signals.

7. Special Features

a.

8. Limiting Weight and Volume Factors

a. The receiver (including the battery supply) shall not exceed the following dimensions: 6 1/4 inches x 3 3/8 inches x 2 1/4 inches. Every effort shall be made to reduce the above dimensions, particularly the

b. The receiver weight shall be kept to a minimum.

9. Provisions for Equipment to Operate in Conjunction with Other Electronic and Intended Associated Equipment

a. This equipment shall be designed to allow operation separately or in conjunction with various existing or planned transmitters to permit two-antenna break-in operation or to simplify hand-generator powered operations. No direct connection to other equipment is planned.

10. Anticipated Power Supply Considerations

a. The radio set shall normally operate from internal batteries.

b. By means of a special plug and cable, the set shall be operable from standard dry batteries such as flashlight cells.

11. Construction and Special Requirements to meet Operation, Transportation, Packaging, and Stowage Conditions.

a. The receiver shall have a flush form factor; that is, when stowed away it shall have no projecting knobs, terminals, or controls which can make storage inconvenient.

b. The ~~radio set~~ Receiver shall be able to stand that degree of vibration, shock, acceleration, and pressure normally encountered in the transportation and drop of similar equipment.

c. The ~~radio set~~ Receiver shall be able to operate reliably and be stored indefinitely in a tropical environment without failure due to such environment.

d. The receiver shall be sufficiently weather-proof to permit operation under adverse conditions due to dust, spray and wind. By means of a special lid or detachable cover, the unit shall be protected against the effects of submersión [redacted].

e. The receiver shall be capable of reliable operation within the temperature extremes of -40° C. to 40° C. (Note: Mercury cells fail to function well at low temperatures, and, if used in this set, will probably not permit operation below 0° C.)

f. A canvas carrying case shall be provided to carry the receiver, spare batteries, and normal accessories.

12. Equipment Arrangement to Promote Operator's Efficiency

a. Controls shall be held to a minimum.

III - Equipment Operation and Maintenance Characteristics

1. Operating Time

a. Operating on a total operating time of less than four hours per day, the battery life shall allow approximately 25 hours of operation before a condition of half-sensitivity is reached.

2. Personnel Considerations

a. No more training or skill shall be required to operate this receiver than is required for similar equipment.

b. Every effort shall be made to provide a peceiver having a minimum of special adjustments or controls.

3. Provisions for Field Maintenance

a. In general, field maintenance of this equipment will not be practical.

REPAIRS ON RECEIVERS AND TUNERS

Receiver #2	Detector Transistor shorted E to C Replaced B.F.O. Trimmer Plates Bent - Replaced Pin pulled through back of connector on tuner Replaced connector
Receiver #4	Feed back circuit of BFO open caused by poor solder connection - Resoldered 3rd IF transformer drift excessive with temperature change- Replaced transformer
Receiver #5	2nd IF Transformer primary open- Replaced
Receiver #9	IF transformers Detuned- Retuned Pin pulled through back of connector on tuner Replaced connector
Tuner #1R	Fungus Proofed- No other troubles found
Tuner #2R	2.6V and Groundleads reversed on connector - Connected Properly
Tuner #7	Replaced RF transistor because E to C short

All tuners recalibrated and cold tested.

All receivers cold tested.

Part Description	Schematic Number	Quantity Required	Date Delivered
Resistor Globar 1/5 watt 1200 ohms	R105, R107	2	Dec. 3, 1957
Resistor Globar 1/5 watt 2200 ohms	R103	1	Dec. 3, 1957
Resistor Globar 1/5 watt 6800 ohms	R106	1	Dec. 3, 1957
Resistor Globar 1/5 watt 10 K ohms	R104	1	Dec. 3, 1957
Resistor IRC 1/4 watt 1500 ohms	R124	1	Dec. 3, 1957
Resistor IRC 1/4 watt 2700 ohms	R121	1	Dec. 3, 1957
Resistor IRC 1/4 watt 56.0 ohms	R123	1	Dec. 3, 1957
Resistor IRC 1/4 watt 6800 ohms	R112, R116	2	Dec. 3, 1957
Resistor IRC 1/4 watt 12K ohms	R118	1	Dec. 3, 1957
Resistor IRC 1/4 watt 15 K ohms	R113, R115, R117, R119	4	Dec. 3, 1957
Resistor IRC 1/4 watt 22 K ohms	R122	1	Dec. 3, 1957
Resistor IRC 1/4 watt 150 K ohms	R120	1	Dec. 3, 1957
Resistor Allen Bradley 1/10 watt 100 K ohms	R125	1	Dec. 3, 1957

SPARE FOR 2-30 TUNER.

Part Description	Schematic Number	Quantity	Date Delivered
Transistor T1050	Q202, Q204 Q201	4	Dec. 3, 1957
Transistor 2N231	Q203	2	"
Transformer 1.55 mc	T203	1	"
Transformer 1.095 mc	T204	1	"
Thermistor D204	RT201	1	"
Capacitor Cerafil .05 mfd 30 VDC	C204, C205 C206, C211 C215	5	"
Capacitor Ceramic Disc .002 mfd 500 VDC	C210	1	"
Capacitor Trimmer 0.5 to 4.5 mfd	C216	1	"
Capacitor Temp. Comp. 100 pf	C217	1	"
Capacitor Mica Mike 3. mmfd	C208	1	"
Capacitor Mica Mike 5. mmfd	C207	1	"
Capacitor Mica Mike 32. mmfd	C218	1	"
Capacitor Mica Mike 38 mmfd	C213	1	"
Capacitor Mica Mike 45 mmfd	C206	1	"
Capacitor Mica Mike 62 mmfd	C201	1	"
Capacitor Mica Mike 220 mmfd	C202	1	"
Capacitor Mica Mike 260 mmfd	C212	1	"
Resistor 1/5 watt Globar 39 ohms	R201	1	"
Resistor 1/5 watt Globar 100 ohms	R209, R111	2	"
Resistor 1/5 watt Globar 220 ohms	R210	1	"
Resistor 1/5 watt Globar 370 ohms	R206	1	"
Resistor 1/5 watt Globar 620 ohms	R208	1	"
Resistor 1/5 watt Globar 1200 ohms	R204, R205	2	"

Part Description	Schematic Number	Quantity	Date Delivered
Resistor 1/5 watt Globar 1800 ohms	R32	1	Dec. 3, 1957
Resistor 1/5 watt Globar 10 K ohms	R33	1	"
Resistor 1/5 watt Globar 30 K ohms	R207	1	"